## REMARKS/ARGUMENTS

In the Office Action dated September 11, 2007, Claims 1-29 are pending. Claims 1, 2, and 8-29 are rejected under 35 U.S.C. § 103(a) as being unpatentable over WO 01/78219 ("Sadarangani, et al.") in view of U.S. Pat. App. Pub. No. 2002/0180295 ("Kaneda, et al."). Claims 3, 4, 6, and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadarangani, et al. and Kaneda, et al. in further view of U.S. Pat. No. 4,308,479 ("Richter"). Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadarangani, et al., Kaneda, et al., and Richter in further view of U.S. Pat. No. 6,211,593 ("Nashiki"). In addition, the Office Action objects to, and requests changes in, Claim 7.

First, regarding the objections, Applicant has amended Claim 7 above as requested in the Office Action and submits that the amendments resolve the concerns noted by the Examiner. The Examiner's careful review of the details of the application is noted with appreciation.

Independent Claim 1 is amended above to incorporate the feature of previous Claim 22, and Claim 22 is canceled. Dependent Claims 23 and 27 are amended to depend directly from Claim 1. No new matter is added, and no new issues are raised. Reconsideration is respectfully requested in light of the above amendments and the following remarks.

Claim 1, which is the sole independent claim, is directed to an electrical machine of the transversal-flux type that includes a stator and a movable element. The stator includes a plurality of stator elements with magnetic flux conductors and an electric conductor forming a winding extending in an essentially closed winding path through each magnetic flux conductor, and the movable element includes a number of permanent-magnet members. As amended above, the movable element is movable in relation to the stator along a movement path and, in particular, the movable element is adapted to carry out a reciprocating motion. Adjacent permanent-magnet members of the movable element are separated from each other by an intermediate member that comprises at least one secondary magnet which has a north pole and a south pole and a magnetic direction extending from the south pole to the north pole and essentially across the magnetic direction of the primary magnet. For example, Figure 1 of the present application schematically illustrates a linear electrical machine 3 in which a movable element 2 moves in relation to a stator 1 back and forth along an essentially rectilinear movement path extending parallel to the

axis a. *See* the present application, page 9, lines 12-19. Each pair of adjacent permanent-magnet members 15 of each movable element 2 is separated by an intermediate member 40. The intermediate members 40 essentially comprise secondary magnets 41, 42, each of which has a magnetic direction that extends transversely, i.e., essentially across (e.g., perpendicular to) the magnetic direction of the associated primary magnet 16. Thus, the magnetic direction of each secondary magnet extends essentially parallel to the movement path of the axis a. *See* the present application, page 13, lines 7-20. The inventors of the present application have surprisingly found that the invention of Claim 1, unlike the cited references, simultaneously obtains a larger pole area and a better concentration of flux in the magnetic flux conductors, while not unnecessarily increasing the weight or size of the moving element.

The configuration set forth in Claim 1 is unlike the devices described in the cited references. Claim 1 and Claim 22 (now incorporated in Claim 1) were rejected in light of Sadarangani, et al. in view of Kaneda, et al. However, even in fair combination, the references do not disclose the configuration of Claim 1. Sadarangani, et al. discloses a device with a linearly-reciprocating moving element 10 including a row of magnets having magnetic direction is transverse to a direction of movement of the moving element 10. Individual magnets of the row of magnets are separated by intermediate elements 13 or spacers (*see* page 11, lines 13-32), which the Office Action asserts to correspond to the recited intermediate members of Claim 1. However, the elements 13 of Sadarangani, et al. are not magnets. In fact, Sadarangani, et al. specifically states that the elements 13 "are magnetically substantially non-conducting." Page 11, lines 23-26. Regardless of the teachings of the other cited references, it would not have been obvious to modify the non-magnetic elements 13 of Sadarangani, et al. with magnets. Indeed, the elements 13 clearly need to be of a non-ferromagnetic nature, since otherwise the magnetic field of the magnets would be shunted therearound, resulting in inefficient operation. On account of the magnets being alternately reversed, a strong magnetic field is established across the elements 13, resulting in inefficient use of flux in respect of the associated stator, namely considerable fringing magnetic fields.

Kaneda, et al. does not cure this deficiency. Moreover, Kaneda, et al. discloses a rotating machine (not a linear reciprocating machine), comprising a stator 1 and a rotor 2, wherein the

rotor 2 includes magnets around its periphery. All the magnets are primary magnets and have their magnetic fields progressively orientated in various directions to reduce effects of fringing fields. None of the magnets correspond to the secondary magnets of Claim 1.

Nor do the other cited references cure the deficiencies of Sadarangani, et al. For example, Richter discloses a construction for a rotor of an electrical machine, shown in Figure 3 as a cross-section along the axis of rotation of the rotor, and in Figures 4 and 5 as a magnetic layout for each stacked layer of the rotor along its longitudinal length. The magnets 48, which establish most of the magnetic flux used by the rotor and are therefore the primary magnets, have a magnetic direction transverse to a direction of rotation of the rotor in contrast to the configuration of claim 1. Even if the flux collector 50 and its associated magnet 62 are regarded as an intermediate member, the associated magnet 62 has a flux direction that is transverse to the magnetic direction of the primary magnet and also transverse to a direction of rotation of the rotor. Further, Richter concerns a rotating machine, not a reciprocating machine. Nashiki discloses a rotor having several primary magnets disposed on a periphery of the rotor with spacer regions therebetween on the rotor which are devoid of any form of secondary magnets.

Furthermore, a person of ordinary skill in the art would not have been motivated to modify Sadarangani, et al., even in light of the other references, since the references do not even address the same problems as the present invention. In this regard, the present application can provide a more magnetically effective and yet light-weight moving element, by employing primary magnets whose magnetic direction is transverse to a direction of movement. *See* Figure 2. As noted above, this is unlike the configuration of Sagarangani, et al. Small magnetic leakage can be obtained by the configuration discussed in the present application (*see* page 1, paragraph [0006]), and the present application provides a result that the total pole area towards magnetic flux conductors will be large and the magnetic flux conductors will concentrate the magnetic flux in a direction to or from the stator (*see* page 2, paragraph [0011]). Conventionally, smaller magnetic flux leakage is addressable by implementing <u>air gaps</u> in a magnetic circuit to be as narrow/small as possible to provide a preferentially lower reluctance path in comparison to a path for fringing magnetic fields. Including secondary <u>magnets</u> on the moving element instead, i.e., in the manner of Claim 1, would not have been obvious. In fact, such secondary magnets

would have been superficially regarded as inappropriate, as seemingly unnecessarily increasing the weight of the moving element. Merely providing sufficient air separation between the primary magnets would conventionally reduce loss of magnetic field by fringing effects.

Further, with respect to the claims rejected in light of Richter, Sadarangani discloses a reciprocating row of magnets in alternate polarisations with a magnetic direction transverse to a direction of reciprocating movement. Even if a person of ordinary skill in the art might consider increasing a width of the intermediate elements 13 or decreasing an air-gap separation between the movable element 10 and the stator so that less flux is shunted across the intermediate elements 13, or employing stronger magnets providing generally greater flux, Richter is not relevant to a reciprocating machine. Moreover, a relatively smaller proportion of the volume of the rotor in Richter is magnet on account of the flux collectors 50, 52 occupying considerable volume relative to the magnets 47, 48, 62, 63. This would result, if theoretically applied to a reciprocating machine, in unnecessarily large weight to its moving element which would be deleterious to performance and operation. Even if the size of the primary magnets were increased, and the flux collector thinner were implemented, the secondary magnets would be rendered almost redundant. In other words, even if Sagarangani, et al. were modified in light of Richter, the result would be, at best, a linear reciprocating machine in which the primary magnets have their magnetic direction in parallel with a direction of movement of the moving member, and the secondary magnets would not be needed.

For the foregoing reasons, Applicant submits that Claim 1 and all of the dependent Claims 2-21 and 23-29 are in condition for allowance.

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## CONCLUSIONS

In view of the remarks presented above, Applicant submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

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